Commonwealth of Pennsylvania
DEPARTMENT OF PUBLIC INSTRUCTION
Harrisburg

Manual of Instruction

COURSE 22
SOIL AND WATER CONSERVATION AND USE

Food Production War Training Program

Bldg.

B630.7
P38ma
no. 22

Prepared under the authority of the State Board for Vocational Education by the Department of Agricultural Education
The Pennsylvania State College

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PREFACE

Course 22, Soil and Water Conservation and Use, is one of a series of courses which have been prepared in the "Food for Victory" program. The object in this manual is to set forth in brief form the immediately important phases in the broad problem of Soil and Water Conservation and Use in Pennsylvania.

This manual is organized into six sections:

I. SUGGESTED COURSE CALENDAR

II. INTRODUCTION

III. SUGGESTED LESSON OUTLINES

IV. EXAMPLES OF JOB BREAK-DOWN
(Job Instruction For Farm Workers)

V. SUGGESTED REFERENCE MATERIAL
Books (A)
Bulletins and Circulars (B)
Visual Aids (C)

VI. SUGGESTED APPROVED PRACTICES WHICH SHOULD DEVELOP FROM THE COURSE

The manual was prepared by Russell B. Dickerson, Itinerant Teacher-Trainer, Specialist in Young and Adult Farmer Instruction, Department of Agricultural Education, The Pennsylvania State College. The preparation was directed by H. C. Fetterolf, Chief, Agricultural Education, State Department of Public Instruction, and Henry S. Brunner, Head, Department of Agricultural Education, The Pennsylvania State College.

Special recognition is given to Dr. Charles F. Noll, Head, Department of Agronomy; to Dr. Fred G. Merkle, Professor of Agronomy; to Professors Frank G. Bamer and Allen E. Cooper, and Dr. Fred V. Grau, of the Agricultural Extension Service, The Pennsylvania State College; to Dr. W. W. Reitz, Educational Relations Section, Northeast Region, Soil Conservation Service, Upper Darby, Pa.; to Mr. Walter C. Gumbel, Director, Soil Conservation Service for Pennsylvania, Harrisburg; and to Mrs. Jessie J. Scott, Farmer Fieldwoman, Pennsylvania Agricultural Adjustment Agency, Harrisburg, for invaluable assistance and guidance in setting up the lesson units and the accompanying suggested topics for study and discussion, in making the job break-downs, and in deciding upon the current references pertinent to Soil and Water Conservation and Use in Pennsylvania.

I. SUGGESTED COURSE CALENDAR

Job Number	Name of Job	Date of Meeting
1.	Understanding the Importance of Soil and Water Conservation and Use	
2.	Understanding the Origin, Nature, and Classification of Soils	
3.	Understanding the Nature and the Effects of Soil and Water Deterioration	
4.	Studying the Nature and the Effects of Soil Erosion on Farm Practices and Yields, and on Man	
5.	Conserving Soil and Water by Approved Land-Use Practices	
6.	Conserving Soil and Water Through the Use of Agronomic Practices	
7.	Conserving Soil and Water Through the Use of Expedient Control Measures	
8.	Practicing Soil and Water Conservation on the General Dairy and Livestock Farms	
9.	Practicing Soil and Water Conservation in Orchards, Vineyards, Commercial and Home Vegetable Gardens	
10.	Practicing Soil and Water Conservation in Recreational, Forest, and Woodland Management	
11.	Wildlife Management Through Soil and Water Conservation and Use	

II. INTRODUCTION

Course 22, "Soil and Water Conservation and Use," is set forth in the Food Production War Training Program for the express purpose of providing systematic instruction in activities and skills related to conserving soil and water and to making the best use of soil and water in the business of producing food and fiber for victory.

Fertile soil is our most valuable natural resource and there is great need in Pennsylvania, as well as in the Nation, for all citizens, especially those who make their living from the soil to acquire a high regard for the necessity of defending its permanent productivity for posterity.

Suggested jobs or lesson outlines.—The eleven (11) suggested lesson topics or jobs were selected after careful analysis of the whole problem of conserving soil and water, and of using both to the greatest advantage, in conference with Dr. C. F. Noll and members of the resident and extension staffs in Agronomy. The lesson outlines are purely suggestive and it is expected that each lesson will be modified to meet local conditions.

It is expected that in some instances, in certain sections of the Commonwealth, jobs other than the eleven included herein will be considered important enough to be included along with, or instead of, some of those listed. It is expected also that more than one meeting will be necessary to give satisfactory instruction in some jobs.

Teaching aims.—The aims and the suggested topics for study and discussion set up in each of the eleven lesson outlines are considered applicable to the respective jobs, but they are by no means considered all-inclusive. If any or all of the suggested topics for study and discussion are incorporated into a similar course of study, the suggested references will be found helpful to the busy teacher. They are offered for the express purpose of bringing teacher efficiency to its best.

The "Job Break-Down" feature of the Job Instruction For Farm Workers procedure is particularly applicable to the teaching of skills in Course 22. The job break-down is based upon the assumption that there are Important Steps (What you should do), and Key Points, (How to do it), in every job. A Step in this instance is, "a logical segment of the operation when something happens to advance the work, while a Key Point is "anything in a step that might make or break the job, avoid injury to the worker, make the work easier to do, i.e., knack, trick, special timing or bit of special information.

With the assistance of the subject matter specialists in Soil and Water Conservation and Use, examples of the job break-down have been developed for several skills requiring specific training. These are given on pp. 27-34. They are intended to serve as patterns which teachers may follow in "breaking down" other activities and in which teachers may be called upon to offer instruction during the course.

References.—The reference materials suggested on pp. 35-40 are considered pertinent to the immediate problem of Soil and Water Conservation and Use. It is advised that at least one copy of each should be available for easy reference. It is assumed that a variety of references which are pertinent to Soil and Water Conservation and Use are already on hand in most schools. They will probably include texts, bulletins, charts, film strips and others, and they may furnish a large portion of the reference material needed. It is important, however, to use the most current references for approved practices in meeting emergency problems. The bulletins and circulars of The Pennsylvania Agricultural Experiment Station and of The Agricultural Extension Service are prepared for Pennsylvania conditions and they are generally the most reliable sources available. However, the publications and visual material available from the United States Department of Agriculture Soil Conservation Service include those which apply to situations peculiar to the Northeast Region of the United States, most of which are generally applicable to Pennsylvania conditions. These have been carefully selected as reliable sources of information.

Attention is especially directed to previously prepared Manuals of Instruction for the Development and Conduct of Agricultural Commodity Courses in the Food Production War Training Program[1] as follows:

Course 6—Increasing Milk Production
Course 7—Increasing Poultry for Meat Production
Course 8—Increasing Egg Production
Course 9—Increasing Pork Production
Course 10—Increasing Beef Production
Course 11—Increasing Mutton, Lamb, and Wool Production
Course 12—Increasing Soybean Production
Course 14—Increasing Vegetable Production (Commercial)
Course 15—Production, Conservation, and Processing of Food for Family Use
Course 21—Home Vegetable Gardening

It is suggested that the above manuals should serve as additional sources of reference, particularly the lesson outlines as they

[1] Food Production War Training Program, State Department of Public Instruction, Harrisburg, Pennsylvania.

apply to problems of land-use in relation to crop and livestock production. In using the above manuals it should be recognized that while the emphasis was directed toward "Increasing" production in the several enterprises, *efficiency* of production was of necessity the watchword in achieving increased production. Efficiency of production is therefore implied in the use of the manuals at all times.

Teachers who plan to organize and conduct Course 22 are urged to refer to the suggestions given in another manual of instruction in the series entitled, "Suggestions To Teachers And Supervisors for the Development and Conduct of Agricultural Commodity Courses."[2]

The suggestions set forth in that manual were prepared for the purpose of aiding individuals in organizing and conducting Agricultural Commodity Courses in the Food Production War Training Program. The manual includes the following sections:

I. Objectives of Courses in the Increased (Efficient) Production of Farm Commodities

II. Things To Do Before Organizing A Commodity Course

III. Form for Surveying Out-of-School Rural and Non-Rural Persons

IV. Suggested Teacher Preparation

V. A Suggested Teaching Plan Using the Conference Procedure

VI. The Importance of Current References

VII. Providing Follow-up of Instruction

For the convenience of the teacher, the suggested reference materials on pp. 35-40 are given by key designation as follows: Books (A), Bulletins and Circulars (B), and Visual Aids (C). In preparing a lesson on any one job, the teacher will find specific references to the different topics suggested. For example: if the reference is A-1, p. 7, it refers to material on page 7 of the first book listed—the material found there is considered pertinent to the topic suggested; if the reference is B-3, it refers to bulletin No. 3 in the list and implies that the content of the entire bulletin is pertinent to the topic; if C-6 is given as a reference, it will refer to item No. 6 in the Visual Aids list.

Approved practices.—The importance of having farmers and others who till the soil understand, select and adopt approved practices which can be put into effect at once in the interest of

[2] Ibid.

conserving and using soil and water effectively cannot be over-emphasized. The suggested approved practices which should develop from the course are set forth on pp. 41-42 as guides to the teacher. During each lesson, certain conclusions should be reached which should result in the adoption of approved practices by individual members. These will constitute the basis for the program of follow-up of instruction.

III. SUGGESTED LESSON OUTLINES

JOB 1. UNDERSTANDING THE IMPORTANCE OF SOIL AND WATER CONSERVATION AND USE

A. Teaching aims—To develop the ability of the farmer—

1. To analyze the soil and water conservation situation on a given farm.
2. To meet the needs for increased production of farm commodities through the use of sound soil and water conservation practices.

B. References for this lesson—(See key list on pp. 35-40)

1. (A)—1, 2, 3, 6, 7, 9
2. (B)—1, 2, 3, 4, 5, 6, 7, 8, 40, 62, 63, 64, 86, 89
3. (C)—1, 2, 3, 4, 6, 10, 12, 13, 14, 28, 29, 30, 34, 43, 46, 47, 51, 52, 53, 54, 55, 56

C. Suggested topics for study and discussion—

1. Considering the national program of soil conservation. A-3, Ch.15.
   a. Education
   b. Action
   c. Flood control
   d. Water facilities
   e. Work of other agencies
   f. Relief of economic and social pressures
2. Analyzing the importance of soil conservation. B-1, No. 1; B-2; B-3; B-4, p. 1-8; B-5, p. 1-23; B-6, p. 2-6; B-7; B-8; B-40; 62; 63; 64; 86; 89; A-1, p. 753; 777; 807; A-2, Ch. 1; A-3, Part I, Ch. 1; A-3, Part 2, Ch. 15; A-6; A-9, p. 429; A-9, p. 416.
   a. Soil formation is a slow process
   b. Plants depend upon soil
   c. Animals depending upon plants could not exist
   d. Animals depending upon other animals could not exist
   e. Man, who depends upon both plants and animals for food, could not survive
   f. Soil supplies many of the things which make man comfortable and happy
      (1) House and furniture from wood
      (2) Paint, varnish and enamel containing oils from plants
      (3) Upholstering, drapes, and clothing from plants and animals

(4) Wallpaper, newspapers, magazines, and writing paper from trees
(5) Grass on our lawns
(6) Trees and shrubs in our landscaping
(7) Plastics from products of the soil, plants, and animals

3. Analyzing the importance of water conservation.
   a. Provides a more equal distribution of water for plant growth throughout the year
   b. Causes a more abundant vegetative growth
   c. Increases crop yields
   d. Maintains a more constant water level in rivers and streams, thereby benefiting navigation, water power, sanitation, and aquatic life
   e. Prevents many streams from going dry periodically throughout the year
   f. Insures a more regular flow of springs and wells and prevents others from going dry
   g. Decreases sudden and heavy runoff of surface water with its accompanying damage of soil erosion, plant injury, and floods
4. Considering the meaning of soil and water conservation and use. B-89.
   a. Application of nutrient materials to aid in building up and maintaining productivity of the soil
      (1) Nitrogen
      (2) Phosphorus
      (3) Potassium
      (4) Calcium
      (5) Trace elements
         (a) Boron
         (b) Zinc
         (c) Copper
         (d) Cobalt
         (e) Manganese
   b. Use of manures, cover, and green manure, crops to aid in building up the water-holding capacity of the soil
   c. Planting leguminous crops to improve fertility and structure of the soil
   d. Reforesting lands unsuited to cultivation
   e. Using agronomic and mechanical practices which will conserve soil and water
      (1) Approved crop rotation
      (2) Proper use of tillage equipment

(3) Contour-strip cropping
(4) Contour planting of orchards
(5) Broadbase terraces
(6) Sodded waterways to carry surplus water to lower levels safely
(7) Diversion terraces
(8) Contour furrows
(9) Sod strips in sloping depressions
(10) Gully control
(11) Drainageways
(12) Streambank and roadbank protection

f. Building and maintaining soil in such a condition that it will absorb as much rainwater as possible and hold it as long as possible
g. Conducting surplus water to lower levels slowly and without damage to soil and crops
h. Providing drainage where necessary
i. Performing such specialized jobs as are required in carrying out needed conservation measures
j. Becoming familiar with the need for, and the advantages to be derived from, the use of soil and water conservation practices

5. Considering the meaning of a productive soil (crops are as good, especially in nutritive value, as the soil in which they grow).
   a. Good depth
   b. Abundance of organic matter
   c. Proper structure
   d. Necessary mineral plant food
   e. Necessary pH level for specific crops
   f. Necessary moisture
6. Becoming familiar with definitions of soil conservation terms. B-10, p. 93-98.

JOB 2. UNDERSTANDING THE ORIGIN, NATURE, AND CLASSIFICATION OF SOILS

A. Teaching aims—To develop the ability of the farmer—

1. To recognize differences in soils on a given farm with respect to origin, formation, classification, and uses.
2. To use the soil intelligently for maximum productivity and conservation.

B. References for this lesson—(See key list on pp. 35-40)

1. (A)—1, 4, 5, 6
2. (B)—65, 87
3. (C)—53, 55

C. Suggested topics for study and discussion—

1. Studying rocks and the soils derived from them.
2. Considering soil development.
3. Studying the composition of soil.

(1, 2, 3) A-6, Chs. 11 and 12

4. Understanding soil classification. A-1, p. 887; 911; 948; 979; A-4, Chs. 1 and 2; A-5, p. 25-61; A-6, Chs. 11 and 12; B-65.
5. Understanding the soil profile. A-6, p. 261-265.
6. Understanding soil types. A-6, p. 285.
7. Understanding the inorganic soil colloids. A-6, Ch. 4.
8. Considering the properties of soils which influence soil erosion. B-87.
   a. Texture. A-3, p. 170
   b. Organic matter. A-3, p. 171
   c. Chemical composition. A-3, p. 171-173
   d. Structures. A-3, p. 174-178

JOB 3. UNDERSTANDING THE NATURE AND THE EFFECTS OF SOIL AND WATER DETERIORATION

A. Teaching aims—To develop the ability of the farmer—
   1. To prevent gross soil and water deterioration.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—1
   2. (B)—1
   3. (C)—1, 2, 3, 4, 5, 6, 10, 13, 14, 34, 42, 43, 52, 57

C. Suggested topics for study and discussion—
   1. Considering the nature of soil and water deterioration. A-1, p. 581-608; B-1, No. 2.
      a. Soil cultivation, in modern practice, produces a certain type of deterioration or depletion
      b. Gross deterioration occurs under at least five headings—
         (1) Biological deterioration
            (a) Plant, animal, and mechanical
         (2) Physical or mechanical deterioration
            (a) Plowing, harrowing, and intertillage
         (3) Nutritional deterioration
            (a) Carbon dioxide from the air
            (b) Water from the soil
            (c) Nutrient elements from the soil
         (4) Moisture adequacy deterioration
            (a) Water from rainfall and snowfall
         (5) Erosional deterioration
            (a) Water and soil runoff
   2. Considering the effects of gross deterioration. A-1, p. 581-608; B-1, No. 3.
      a. Biological
         (1) Reduced cover from annual plants
         (2) Large quantities of organic matter (plant tissue) removed annually
         (3) Wild animal life is nearly exterminated
         (4) Microorganisms are likely to be reduced in numbers
      b. Physical or mechanical
         (1) There is a tendency for the permanent structural condition of the soil, as found in virgin land, to be destroyed by the exposure resulting from cultural practices
            (a) Leveling and filling in the depressions encourages rainwater to run off

(b) Natural impounding reservoirs may be destroyed
(c) Vertical channels are broken up and replaced with horizontal channels, thus encouraging surface runoff and discouraging penetration
(d) The granules or crumbs of soil are subjected to destruction when exposed to beating rains

c. Nutritional
(1) The biologically active nutrient elements are gradually exhausted through cultivation
(a) Nutrients required to produce cultivated crops are lost from the soil when crops are sold from the farm
(b) Cultivation accelerates the loss of nutrients by leaching and surface runoff
1. Greatest in fall, winter, and early spring
2. Especially heavy when the soil is bare

d. Moisture adequacy
(1) Cultivation tends to eliminate the surface obstacles which delay runoff of rainwater, and depression and storage areas are eliminated
(a) Vertical channels are destroyed
(b) Horizontal tracks are produced
(c) Surface runoff is great
(d) Infiltration is small
(e) Deep and intensive root systems are discouraged
(f) Drought injury is frequent
(g) Insufficient moisture causes poor growth, hence poor cover
(h) Lack of cover induces runoff

e. Erosional
(1) Runoff of rainwater in erosion of the soil
(a) Varying lengths of time under culture and
(b) The kind of culture inevitably will cause runoff and erosion

JOB 4. STUDYING THE NATURE AND THE EFFECTS OF SOIL EROSION ON FARM PRACTICES AND YIELDS, AND ON MAN

A. Teaching aims—To develop the ability of the farmer—
   1. To eliminate the causes of soil erosion on a given farm.
   2. To increase yields as the result of improved soil and water conservation practices.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—1, 2, 3, 6
   2. (B)—9, 14, 86, 91
   3. (C)—1, 4, 6, 10, 13, 14, 34, 42, 43, 52, 53, 54, 56, 57

C. Suggested topics for study and discussion—
   1. Considering the nature of soil erosion. B-9; C-1; A-3, Chs. 3, 4, 23, 24, 26; C-4; 6; 10; 13.
      a. Accelerated surface runoff
      b. Sheet erosion
      c. Rill erosion
      d. Gully erosion
      e. Streambank cutting
   2. Considering the effects of soil erosion. B-9; C-1; A-1, p. 581-608; A-2, Ch. 3; A-3, Ch. 3; B-86; C-14; 34; B-14
      a. Gradual removal of the topsoil resulting in a
      b. Gradual rising of the subsoil
      c. Remaining topsoil becomes lighter in color, lower in humus, and richer in clay
      d. Problems resulting from the removal of topsoil
         (1) A progressive decrease in the total available nitrogen
         (2) A decrease in organic matter
         (3) Less bacterial action
         (4) Less decay or fermentation in the soil
         (5) A lower availability of most mineral nutrient elements
      e. Many cultural problems become prevalent
         (1) Clay, devoid of humus, not easily put into good physical condition
         (2) Seedbed preparation must be crowded into a very short period of time
      f. Poor germination, particularly of small seeds, is common in eroded soil
         (1) There is increased difficulty in obtaining good stands of our best soil conserving crops
            (a) Small seeded grasses and legumes

g. Weeds are more difficult to control
h. There is a general depletion of the soil moisture supply
   (1) Absence of topsoil prevents absorption of water
   (2) Absence of topsoil increases runoff
   (3) Absence of topsoil increases evaporation
i. There is a quicker and more frequent injury from drought
j. There is increased cost of production through
   (1) Decreased crop yields
   (2) More fertilizer required
   (3) Time consumed in filling gullies
   (4) Time consumed in picking stones
   (5) Time consumed in removing eroded soil
   (6) Deposition of eroded soil on crop lands
k. There is increased cost of highway maintenance
l. There is indication of a gradual lowering of the subsoil supply of water and the water table
m. Evaporation is greater on eroded soil
n. The occurrence of gullies in fields impede all agricultural operations
o. Floods are increased in frequency and intensity as the result of soil erosion
p. Silting up of reservoirs and silt covered fertile river bottoms result from accelerated erosion. B-91
q. There is evidence of our yields becoming lower and our producing capacity less as a result of soil and water erosion
   (1) Soil deterioration has caused a gradual decline in fertility
   (2) Fields and farms pass into abandonment each year

3. Considering the variable causes of erosion. B-1, No. 4.
   a. Internal erosion variables
      (1) Geological origin and character of parent rock and soil material have their influence
         (a) Certain geological formations erode more seriously than others
      (2) Topography, elevation, slope, exposure, and concentration areas are influential
         (a) Sharply cut up topography
         (b) High elevations
         (c) Steep slopes
         (d) Wind and sun exposure
         (e) Water collected at some higher point
      (3) Character of soil mantle—texture, structure, stones, character of clay, and subsoil characteristics

(a) Rapidity of erosion, and the kind of erosion is determined by varying degrees of changes in the soil mantle

b. External erosional variables
   (1) Climate
      (a) Temperature
      (b) Rainfall—amount, distribution, intensity
   (2) Vegetable cover
      (a) Kind of plants grown
      (b) Rotations
      (c) Cultivation
         1. Length of time under culture
         2. Character of mechanical operations

JOB 5. CONSERVING SOIL AND WATER BY APPROVED LAND-USE PRACTICES

A. Teaching aims—To develop the ability of the farmer—
   1. To plan and carry out a program of improved land-use and soil and water conservation.
   2. To select and carry out approved land-use practices in connection with a soil and water conservation program.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—1, 9
   2. (B)—1, 10, 11, 31, 50, 74, 76, 77, 78, 88, 90
   3. (C)—9, 24, 29, 30, 37, 38, 39, 40, 45, 52

C. Suggested topics for study and discussion—
   1. Make a base map of the farm. B-10, p. 9-17; B-11.
      a. Secure and use aerial photographs. A-1, p. 1002.
   2. Make a soil conservation survey of the farm. B-10, p. 18-33; B-11; 88; 90.
      a. Symbols for use in map making. B-10, plates 1-6, opposite page 14
      b. Definitions of soil conservation terms. B-10, p. 93-98
      c. Make a land-use capability map based on the conservation survey
   3. Determine the use capabilities of the lands included in the farm. B-10, p. 34-43; B-11; 31; 76; 77; 78; A-9, p. 398.
   4. Plan a water-disposal system for the farm. B-10, p. 44-50; B-50.
   5. Re-plan the farm layout. B-10, p. 51-56; 76, 77.
      a. Rearrangement of fields, fences, roads
      b. Convert eroded and erodible land, and steep slopes to more practical use.
         (1) Woodland
         (2) Pasture
         (3) Long-time hay
      c. Drain seepage areas and convert to practical use B-50; 74
   6. Make inventory of present livestock, feed, cash crops and adjust to revised farm layout. B-76; 90.
   7. Revise farm business to balance feed and livestock. B-76; 90.
   8. Plan a land-use program for the farm. B-1, No. 5; A-9, p. 398; A-9, p. 1138; B-10, p. 57-65; B-76; 77; 78; 90.

JOB 6. CONSERVING SOIL AND WATER THROUGH THE USE OF AGRONOMIC PRACTICES

A. Teaching aims—To develop the ability of the farmer—
   1. To select and carry out the agronomic practices that are best adapted to the home farm situation.
   2. To adapt a cropping system consistent with various land-use and conservation factors.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—1, 3
   2. (B)—1, 10, 12 to 28 incl.; 30, 32 to 41 incl.; 66 to 72 incl.; 86
   3. (C)—9, 12, 18, 20, 24, 25, 26, 27, 33, 37, 38, 39, 40, 52

C. Suggested topics for study and discussion—
   1. Plan conservation practices for cultivated lands.
      a. Rotations A-1, p. 406; B-10, p. 66-75; B-27; 28; 32; 39; 40; 41; B-64, p. 7-9; B-1, No. 5; A-3, p. 339-346
         (1) Topsoil on upper slopes is usually thinner
         (2) Consider a longer rotation for upper slope areas
            (a) Long-time hay, pasture, woodlot
         (3) Different fields may require different rotations
         (4) Use more soil-conserving and soil-building crops B-12; B-27
            (a) Adapted native and imported grasses and legumes A-3, Ch. 17
         (5) Use soil depleting crops judiciously. B-12
         (6) Avoid continuous one-crop systems. B-41
   2. Plan conservation practices for pasture lands. B-10, p. 76-83; B-33 to 37 incl., 41; C-20; 27.
      a. Renovate to introduce better adapted species and to incorporate soil amendments in the root zone
      b. Fence to control grazing
      c. Mow to eliminate weeds and waste grass, and to keep grass young and palatable
      d. Rotate grazing to promote uniform grazing and prevent over grazing
      e. Lime, fertilize, manure, and scatter droppings
      f. Use contour furrows where needed
   3. Maintain the fertility of the soil. A-1, p. 469; 487; 522; 546.
      a. Germination and early growth will be much more rapid B-39; 13; 14; 15; 16; B-1, No. 5; B-32; 38; 41
      b. Nitrogen. A-1, p. 361

c. Phosphorus. A-1, p. 377; B-39
d. Potassium. A-1, p. 397
e. Calcium. A-1, p. 563; B-17; 18; 19; 20; 21; 39

4. Maintain the organic matter content of the soil. A-1, p. 347; 431; 445; 462; 929; B-22; 23; 24; 25; 26; 27; 30; 32; 39; 41.
   a. Keep the soil covered with cover crops. C-18; 33; A-3, p. 370-374
   b. Use green manure and crop residues. A-3, p. 375-377
5. Maintain the permeability of the soil. A-1, p. 321; 329; B-28; 32; B-1, No. 5.
   a. Increases the water-holding capacity
   b. Avoid surface compaction
      (1) Cattle tramping in pastures and paddocks
      (2) Driving cattle and horses, and running machinery over land when the soil is wet
6. Maintain the soil moisture. A-1, p. 704; 897; B-29; 32; B-1, No. 5.
   a. Increases the rate of growth and completeness of vegetative cover
7. Improve or establish long-time hay land. (Meadows) B-66; 67; 68; 69; 70; 71; 72.
   a. Lime and fertilize in accordance with soil and crop needs
   b. Seed

JOB 7. CONSERVING SOIL AND WATER THROUGH THE USE OF EXPEDIENT CONTROL MEASURES

A. Teaching aims—To develop the ability of the farmer—
   1. To plan and carry out a program of using expedient control measures appropriate for a given farm situation.
   2. To gain the skills incident to establishing such expedient soil and water conservation measures as may be necessary on a given farm.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—1, 2, 3
   2. (B)—1, 39, 42 to 55 incl.; 64, 73, 74, 85
   3. (C)—1, 2, 3, 5, 7, 8, 11, 15, 16, 17, 19, 23, 31, 32, 49, 52

C. Suggested topics for study and discussion—
   1. Establish and maintain contour strip cropping. B-39; 42; 43; 44; 45; 46; 47; 48; A-1, p. 635; A-2, Chs. 9 and 10; A-3, Ch. 19; B-64, p. 8; B-85; C-8; 15; 16; B-1; No. 6; A-3, p. 346-358.
   2. Practice contour planting of orchards. B-79, 80; B-1, No. 8.
   3. Establish terraces. B-1, No. 6; B-39; 44; 49; 50; 51; A-1, p. 649; A-2, Ch. 11; A-3, Ch. 20; C-17; 49.
      a. Broadbase. B-64, p. 10
      b. Diversion terrace (ditch). B-64, p. 9
   4. Establish contour furrows. C-2; 3; 7; 32.
      a. In pastures particularly. A-3, Ch. 19; A-1, p. 656; A-2, p. 200-206
   5. Practice gully control and repair. B-52; A-1, p. 662; A-2, Ch. 13; A-3, Ch. 23; C-1; 2; 3; B-64, p. 11; C-5; 11; 19; 31.
      a. Control their individual watersheds or concentration areas
      b. Fill in and revegetate old gullies and scars. A-3, p. 363-368
   6. Establish sod waterways. A-1, p. 723; B-50; A-3, p. 368-370.
   7. Install tile drains to prevent seepage areas. B-74.
   8. Provide streambank protection. A-3, Ch. 26; A-2, Ch. 17.
      a. Levees
      b. Deflectors
      c. Cribbing
   9. Practice roadbank protection. A-2, Ch. 16; A-3, Ch. 24; B-73; B-64; B-55; B-1, No. 9.
   10. Construct and maintain farm ponds. B-53; 54; C-23.

JOB 8. PRACTICING SOIL AND WATER CONSERVATION ON THE GENERAL DAIRY AND LIVESTOCK FARMS

A. Teaching aims—To develop the ability of the farmer—
   1. To plan and carry out erosion prevention practices on dairy and livestock farms.
   2. To improve and maintain the productivity of dairy and livestock farms in relation to soil and water conservation practices.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—1, 2
   2. (B)—1, 12, 26, 27, 33, 34, 39, 42, 44, 56, 74 to 78 incl.
   3. (C)—9, 27, 52

C. Suggested topics for study and discussion—
   1. Vegetative measures. A-2, Ch. 12; B-10; Jobs V to X incl.; B-12; 26; 27; 33; 34; 39; B-1, No. 7.
      a. Hay—substitute deep-rooted ones for the shallow-rooted ones
      b. Establish long-time meadows
      c. Use cover crops to decrease runoff and erosion
      d. Use grass silage
      e. Practice contour strip-cropping
         (1) Fortify the rotation with soil-building and soil-conserving crops
      f. Maintain grassed waterways and headlands
      g. Practice pasture management
         (1) Renovate
         (2) Fence
         (3) Manure
         (4) Lime
         (5) Fertilize
         (6) Rotate grazing, avoid over-grazing
         (7) Scatter droppings
         (8) Avoid excessive tramping and compacting
         (9) Mow
   2. Expedient measures. B-39; 42; 44; 56; 74; B-1, No. 6.
      a. Streambank protection
         (1) Pasture and hay lands particularly
      b. Stone fence management
         (1) Eventual removal
      c. Contour furrows
      d. Drainage
         (1) Eliminate seepage areas

e. Diversion of water, broadbase terraces, diversion terraces
f. Gully control

3. Management measures. B-75; 76; 77; 78; B-1, No. 7.
   a. Handling manure systematically. B-75; A-1, p. 445-461
      (1) Soil and water conservation on livestock farms begins in the stable
      (2) Solid as well as liquid manure serves well in maintaining good structural condition of the soil
   b. Rearrange fields to accommodate the application of approved soil and water conservation practices. B-76; 77

JOB 9. PRACTICING SOIL AND WATER CONSERVATION IN ORCHARDS, VINEYARDS, COMMERCIAL AND HOME VEGETABLE GARDENS

A. Teaching aims—To develop the ability of the farmer—
   1. To conserve soil and water in the management of the orchard, vineyard, commercial and home vegetable gardens.
   2. To establish practices that will improve the productivity of the soil and increase soil and water conservation.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—8
   2. (B)—1, 79, 80
   3. (C)—35, 52

C. Suggested topics for study and discussion—
   1. Orchards. B-79; 80; B-1, No. 8.
      a. Control compaction of soil caused by hauling equipment over wet land
      b. Practice sod culture or cover cropping. C-35.
         (1) Leave herbage produced by sod and cover crops on the land to rot and to be incorporated at the surface
         (2) Apply mulching materials when practicable
      c. Avoid pasturing the orchard
      d. Plant trees on the contour
         (1) Particularly when clean cultivation is desired
      e. Prevent runoff by terracing, contour planting, and mulching
      f. Apply balanced fertilizers as far as possible
      g. Maintain good structure of the orchard soil through intercropping and organic matter
   2. Vineyards. B-1, No. 8.
      a. Plant on the contour b. Practice cover cropping
      c. Use organic mulches
   3. Commercial gardens. B-1, No. 8.
      a. Maintain a good physical condition of the soil through
         (1) Animal manures (2) Sod crops and cover crops
      b. Avoid minor element deficiencies by
         (1) Maintaining active organic matter
   4. Home gardens. B-1, No. 8.
      a. Maintain a good structural condition of the soil by
         (1) Avoiding excessive tramping between rows
         (2) Refraining from spading when excessively wet or dry
         (3) Using animal manure frequently
         (4) Growing sod-producing cover crops

JOB 10. PRACTICING SOIL AND WATER CONSERVATION IN RECREATIONAL, FOREST, AND WOODLAND MANAGEMENT

A. Teaching aims—To develop the ability of the farmer—
   1. To increase the productivity of recreational lands, forest, and woodland.
   2. To prevent practices that will cause deterioriation and destruction of these lands.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—1, 3, 9
   2. (B)—1, 10, 57, 58, 59, 60, 81, 83
   3. (C)—21, 36, 41, 42, 44, 52

C. Suggested topics for study and discussion—
   1. Recreational soil management. B-1, No. 9.
      a. Remove and store for later use good topsoil during the grading
      b. Loosen leveled subsoil that has been packed by excavating and grading machinery
      c. Cover bedrock and leveled subsoil with regraded subsoil before returning the topsoil
      d. Avoid the rounded mound as a lawn surface in order to prevent surface runoff and resulting poor growth of turf
      e. Make slopes into level terraces as far as possible
      f. Finish terrace fronts with loose stone walls tilting inwards, or with embankments planted to good covering perennial plants
      g. Grade the entire lawn as nearly level as possible
      h. Avoid compaction of the soil in early spring and following wet periods by excessive tramping
      i. Avoid excessively close mowing
      j. Use lime for legumes
      k. Use fertilizers in accordance with soil and plant needs
   2. Forest and woodland. B-10, p. 84; A-1, p. 737; A-3, Ch. 18; B-57; 58; 59; 60; A-9, p. 458; 533; B-81; 83; C-21; 36; 41; 42; 44.
      a. Prevent fires
         (1) Maintain vegetative cover and organic matter
      b. Fence to protect from grazing
      c. Make improvement (selective) cuttings to recommended standards for rapid reproduction
      d. Control log roads and skids
      e. Make renewal plantings
         (1) Inter-plant where practicable
      f. Follow systematic harvesting practices for sustained yield

JOB 11. WILDLIFE MANAGEMENT THROUGH SOIL AND WATER CONSERVATION AND USE

A. Teaching aims—To develop the ability of the farmer—
   1. To maintain cover and feed for wildlife.
   2. To incorporate practical wildlife management with the soil and water conservation program of a given farm.

B. References for this lesson—(See key list on pp. 35-40)
   1. (A)—3
   2. (B)—10, 53, 61, 81, 82, 83, 84
   3. (C)—22, 48, 50, 52

C. Suggested topics for study and discussion—
   1. Plan an erosion control program. B-10, p. 89; B-61; A-3, Ch. 28.
      a. Plant wet and rough spots to suitable shrubs
      b. Plant field borders next to woodland to permanent hardy grasses and legumes. B-82; 84
      c. Plant a border of low shrubs around woodlot and new plantations to attract insect-eating birds. B-81; 83
         (1) Shelter and food for migratory birds
      d. Plant contour hedges where needed. B-81.
      e. In gully stabilization, slope banks and plant or seed to shrubs and grasses that have wildlife value
      f. Maintain ponds for wildlife. B-53.

IV. EXAMPLES OF JOB BREAK-DOWN (JOB INSTRUCTION FOR FARM WORKERS)

1. Laying Out a Contour Strip

IMPORTANT STEPS	KEY POINTS
1. Assemble equipment	Level—"Locke" type or carpenter's level. Carpenter's level with mirror attached can be held by hand to eye or mounted on a pointed 5′ to 6′ stake Stakes — Approximately 5 for each acre to be laid out. Plastering lath make ideal stakes Hammer or hatchet 100-foot tape and binder twine, or sash cord or light chain
2. Walk over farm or area to be laid out in strips with farmer	Observe particularly— Length of slope Steepness of slope Topography Possibility of eliminating fences, etc., to combine fields Whether or not water from neighboring farm presents a problem
3. Discuss present and proposed layout with farmer	Acres of plow land Acres of permanent pasture Rotations and cover crops Ease of operating machinery on level Soil and water conservation Livestock needs Forest trees
4. Decide when in the rotation to start strip farming	*Examples* feasible in most rotations— Field in hay sod. Alternate strips may be plowed for corn and remaining strips kept for hay Field in corn. Alternate strips seeded to wheat in fall and the remaining strips to corn or oats the next spring

	Field in corn. Entire field seeded to wheat in fall and alternating strips turned for corn the following spring
	Field in wheat or oats. Seed alternate strips to clover in spring and the unseeded strips to wheat again in the fall
	Other field set-ups handled similarly
5. Discuss strip width with farmer	Strips between 80 and 100 feet in width give best results
	Example—General farm—
	Principal intertilled crop—corn
	Distance between rows—$3\frac{1}{2}'$
	Strip 24 corn rows wide = $24 \times 3\frac{1}{2}' = 84'$
	Add 2′ for ease of operation $84' + 2' = 86'$
	Example—Specialized farm—
	Principal intertilled crop—potatoes
	Distance between potato rows—34″ or 2 5/6′
	8-row sprayer used, then 16 rows = 1 round trip
	One round trip $16 \times 2\ 5/6' = 45\frac{1}{3}'$
	Two round trips $2 \times 45\frac{1}{3}' = 90\frac{2}{3}'$ or 91′
	Add 2′ for ease of operation— $91' + 2' = 93'$
6. Establish base line	The initial base line is established at a place along the slope which is fairly representative of the slope and topography. Note: Usually (but not always) somewhere about one-half to two-thirds the way up the slope
	Three men constitute a staking crew
	One man uses the level, another serves as target or rodman

	and the third man follows with stakes and hammer
	The target should be the same height from the ground as the level used in sighting. (Example—The man using the level holds same to his eye, which is $5\frac{1}{2}$ feet from the ground. Then the target should be $5\frac{1}{2}$ feet from the ground)
	Set stakes about 100 feet apart (approx. 33 steps) on the exact level or contour. The more the base line curves, the closer stakes should be set. This gives a clearer outline
7. Adjust base line	It may be desirable to smooth out abrupt and unnecessary curves and thus make easier farming by shifting some of the stakes a few feet up or down the hill, providing this can be done without getting too much off the true contour
8. Measure width of strips	Three men constitute a measuring crew
	Use tape, binder twine, sash cord or light chain. If binder twine is used, use two strands
	One man works from stakes in base line, the other two set new line of stakes
	Measure up or down the slope at right angles (using outstretched arm method) from each stake in the base line, thus setting another line of stakes parallel to it
	Additional lines are set by measuring and sighting on the stakes in the first and second line

Check each line of stakes with the level and when the deviation from the true contour is too great, establish another base line and proceed as at first

Areas (most times uneven) left between strips located by measuring from more than one base line are called "correction strips"

9. Plow out stake lines

If area staked off will not be plowed for some time, then follow each stake line with plow making a light furrow

If plow is drawn by horses, a man should walk a short distance ahead of the horses, thus enabling the driver to make a smoother furrow

If plow is drawn by tractor, the driver is seated high enough to see ahead, thus eliminating the extra man

2. Laying Out a Diversion Terrace

IMPORTANT STEPS	KEY POINTS
1. Walk over the problem area with the farmer, discussing need for and location of diversion terrace or terraces	Outlet—natural, constructed or combination of both Length of slope Steepness of slope Topography Depth of soil Presence of rock outcrop and rock ledges Does water from neighboring farm present a problem?
2. Establish terrace line	To facilitate construction, diversion terraces should be located on the more gentle parts of the slope If more than one diversion terrace is recommended for a slope, the top one is usually (but not always) laid out first Three men constitute a staking crew One man uses level, another serves as rodman and the third follows with stakes and hammer Start stake line (usually but not always) at outlet. Drive first stake here Set stakes 50 feet apart by measuring or pacing. Set stakes closer on sharp curves to give a clearer outline Allow *not more* than 6 inches grade every 50 feet. Quite often 2 to 4 inches grade every 50 feet is sufficient. Note: A diversion terrace should have sufficient grade to dispose of the water without its cutting the terrace channel
3. Plow out stake lines	If the diversion terrace will not be built immediately after the

	staking is finished, then follow the stake line with a plow making a light furrow. This will help eliminate errors
4. Decide upon the size of channel	Size of channel (width and depth) will vary with 1—Acreage above diversion terrace, 2—Use of land above diversion terrace (plow land, permanent pasture, long-time hay or woods), 3—Steepness of land above diversion terrace
5. Discuss the construction of terrace	Diversion terraces can be built with a moldboard plow, disc terracer, slip scraper, martin ditcher, or special grading and terracing equipment. Procedure will vary somewhat with type of equipment used
6. Discuss seeding of the terrace	Seeding mixtures of clover, timothy, rye grass, bluegrass, etc., or special mixtures on diversion terraces or constructed outlets is necessary. Similar seeding on filter strips (25-35 feet wide) above diversion terraces is also necessary. Seedbed should be well prepared, manured, limed and fertilized
	Note: When diversion terraces empty into a constructed outlet which is to be seeded, a tough sod should develop before the terraces are constructed or before water is turned into the outlet

3. Laying Out a Contour Orchard

IMPORTANT STEPS	KEY POINTS
1. Assemble equipment	Level—"Locke" type, or any other type of level available Stakes—Approximately 20 per acre. Plastering lath makes ideal stakes Hammer or hatchet Tape line—50-foot or 100-foot Equipment to plow out contour rows immediately after they are staked
2. Walk over area to be planted to orchard	Observe particularly— Length of slope General topography of area Fence rows to eliminate Location of service roads
3. Discuss orchard layout with farmer	Type of fruit to be grown (apples, peaches, cherries, pears) Cultural practices (sod or cover crop) Width of row and spacing of trees in row (spread and pinch in to conform to slope change) Distance between rows varies with slope change (average distance will be standard, i.e., 24′ for peaches)
4. Establish contour lines for tree rows	Initial contour line is established at a mid-point on the slope. Stakes driven every 50 feet Second contour line is established above or below the first line. The distance is determined by width of row desired by the farmer in accordance with tree crop to be planted.

	Example—Peaches—24 feet Apples—40 feet Sour Cherries—24 feet
	Explain fluctuations in row width
	Example—A 24-foot row may fluctuate from 20 to 28 feet because of slope change
	Point rows are necessary (to be laid out after all full-length rows are established)
	Measure distance between rows at average slope
	Plow out rows as soon as staked. Throw furrow down hill. It is best to plow while staking
5. Planting trees on the contour	Trees are *not* lined up and down hill
	Trees are planted at regular intervals in the contour row
	Where rows pinch together, trees may be staggered to get proper spacing between rows and trees
	Dig holes in furrow and plant trees as usual
	After trees are properly planted plow two or three furrows against trees from upper side of contour rows. This establishes small ridges on the contour row
	Repeat this practice each year for three years by plowing toward trees with two to four furrows
6. Establish proper cultural practices	Sod or cover crop is essential in contour planted orchards
	Cultivation should always be on the contour. Note—Crossing contours with tillage tools will destroy contour ridges and result in soil and moisture losses

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10. Soil Erosion In The United States. (48 frames), 467, U.S.D.A.
11. Gully Prevention And Control. (75 frames), 504, U.S.D.A.
12. A Story Of Topsoil In The Northeast. (48 frames), 520. U.S.D.A.
13. Erosion—Whose Problem? (33 frames), 523, U.S.D.A.

Conservation Charts[3]

14. Soil Erosion—Cause And Effect. Chart 1, U.S.D.A.
15. Contour Farming For Soil And Water Conservation. Chart 2, U.S.D.A.
16. Strip Cropping—An Erosion-Control Practice. Chart 3, U.S. D.A.
17. Terraces For Erosion Control. Chart 4, U.S.D.A.
18. Cover Crops Protect Soil. Chart 5, U.S.D.A.
19. Gully Control. Chart 6, U.S.D.A.
20. Saving Soil And Water On Pasture Lands. Chart 7, U.S.D.A.
21. Trees And Shrubs For Erosion Control. Chart 8, U.S.D.A.
22. Wildlife—A Safe Use For Erodible Land. Chart 9, U.S.D.A.
23. Farm Ponds. Chart 10, U.S.D.A.
24. Soil Management Program For Crop Land. Chart 11, U.S.D.A.
25. Effects Of Cropping Plan On Soil Losses. Chart 12, U.S.D.A.
26. The Story Of Three Cornfields. Chart 13, U.S.D.A.
27. Improved Pastures. Chart 14, U.S.D.A.

28. Financial Insecurity Follows Erosion Of The Soil. Chart 15, U.S.D.A.
29. Erosion Control Starts With An Inventory Of Farm Resources. Chart 16, U.S.D.A.
30. Soil Conservation Calls For Definite Long-Time Planning. Chart 17, U.S.D.A.
31. Locust Reclaims Gullied Area. Chart 18, U.S.D.A.
32. Contour Furrows. Chart 19, U.S.D.A.
33. Winter Cover Saves Soil. Chart 20, U.S.D.A.
34. Soil Erosion Destroyed This Community. Chart 21, U.S.D.A.
35. Hillside Orchards Need Cover To Protect Soil From Erosion. Chart 26, U.S.D.A.
36. Trees Conserve Soil And Water. Chart 27, U.S.D.A.
37. Grassland Farming For Soil Conservation. Chart 28, U.S.D.A.
38. Grassland Agriculture Is Permanent. Chart 29, U.S.D.A.
39. Grass And Legumes Improve The Rotation. Chart 30, U.S.D.A.
40. A Grass Economy Is Vital. Chart 31, U.S.D.A.
41. If Protected From Fire And Grazing, Forest Cover Affords Many Benefits. Chart 32, U.S.D.A.
42. Grazed Woodland—Loses Soil And Water, Produces Less Timber, Yields Little Forage. Chart 33, U.S.D.A.
43. How Badly Has Erosion Damaged Your Farm? Chart 34, U.S. D.A.
44. The Tree And The Soil. Chart 35, U.S.D.A.
45. Reconnaissance Land Utilization Map Of Pennsylvania. The Pennsylvania State College, State College, Pa.

Motion Pictures (Sound)[4]

46. The River. (3 reels, running time about 35 minutes)
47. Muddy Waters. (1 reel, running time about 10 minutes)
48. Once Upon A Time. (1 reel—silent, running time about 12 minutes)
49. Terracing In The Northeast. (1 reel, running time about 10 minutes)
50. A Heritage We Guard. (3 reels, running time about 28 minutes)
51. For Years To Come. (2 reels)

Official Organ Of The Soil Conservation Service[5]

52. Soil Conservation. Issued monthly by Soil Conservation Service, U.S.D.A.
53. Samples Of Soil From Several Farms.
54. Samples Of Soil Profiles From Well Conserved Soil.
55. Samples Of Typical Soil Types.
56. Samples Of Topsoils That Are High In Organic Matter.
57. Samples Of Soil Profiles From Eroded Areas.

[1] Publications of the United States Department of Agriculture on Soil Conservation may be secured from the Northeast Regional Office, Soil Conservation Service, Upper Darby, Pa.
[2] Ibid.
[3] Ibid.
[4] Ibid.
[5] Ibid.

VI. SUGGESTED APPROVED PRACTICES WHICH SHOULD DEVELOP FROM THE COURSE

1. Use soil and water intelligently for maximum conservation and productivity.
2. Prevent gross soil and water deterioration by adopting approved land-use practices.
3. Eliminate long periods of no, or little vegetable cover, inadequate tillage, and improper mechanical practices.
4. Develop a cropping system consistent with sound land use, and with the livestock enterprises best adapted to the farm and the operating personnel.
5. Make adjustments in fields to provide fields or combinations of fields approximately equal in size consistent with the topography and rotation system.
6. Drain wet spots to improve otherwise good land.
7. Consider the possibility of increasing the length of rotation on rolling and steep lands, thus keeping such land in hay and pasture over a longer period.
8. Use legumes to increase the nitrogen content of the soil as well as to improve or maintain the general structure of the soil.
9. Use lime and fertilizer on sod and row crops in accordance with the deficiencies and needs of the crops in question.
10. Improve or maintain the organic content of the soil by generous use of stable manure and green manure crops.
11. Establish contour strips consistent with a practical land-use program for the farm.
12. Construct broadbase and/or diversion terraces where practicable on the farm to prevent and reduce erosion.
13. Establish sod drainageways to prevent gullies.
14. Control streambank and roadbank cutting as far as possible to conserve soil and water on the farm.
15. Adopt a program for the systematic coverage of the farm with the manure produced by the livestock on the farm.
16. Provide for the production and/or use of ample quantities of bedding material suitable for absorbing the liquid excreta produced in the stables.
17. Reinforce stable manure and prevent nitrogen loss by sprinkling superphosphate in feeding pens, in gutters, and on individual loads of manure.
18. Practice sod culture and contour planting consistent with practical management in the orchard.

19. Use cover crops generously in the orchard, vineyard, and in the home and commercial vegetable garden to prevent extended exposure of bare ground and accompanying erosion.
20. Plant green manure crops generously in home and commercial vegetable gardens where stable manure cannot be obtained.
21. Construct a deep, well drained, and a rich seedbed for the lawn.
22. Prevent surface runoff on lawns by making slopes into level terraces as far as practicable.
23. Maintain and improve forest and woodlot areas to conserve soil and water on adjacent crop land by preventing fires, avoiding grazing, and by making improvement cuttings.
24. Plant wet and rough spots on the farm to shrubs and other plants suitable for wildlife shelter, and food.
25. Plant field borders and headlands to permanent hardy grasses and legumes for wildlife food sources.
26. Maintain ponds for aquatic life.

Aaron Bldg.

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